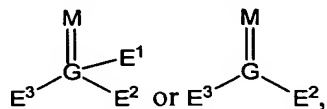


CLAIMS

1. A composition, comprising:

a compound able to react with an agent having a structure:



5 wherein G is an electrophilic atom, at least one E in the structure is electron-withdrawing, and M is a chalcogen or NR, R being an alkyl, to produce a product having greater emissivity than the compound, wherein the product comprises at least a portion of the compound that has been cyclized upon reaction with the agent.

10

2. The composition of claim 1, wherein the agent comprises a phosphate ester.

3. The composition of claim 1, wherein M is oxygen.

15

4. The composition of claim 1, wherein M is sulfur.

5. The composition of claim 1, wherein M is NR.

6. The composition of claim 1, wherein G is phosphorous.

20

7. The composition of claim 1, wherein G is arsenic.

8. The composition of claim 1, wherein G is sulfur.

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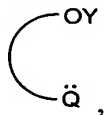
9. The composition of claim 1, wherein G is carbon.


10. The composition of claim 1, wherein at least one E in the structure is a halogen.

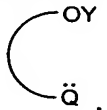
11. The composition of claim 1, wherein each E in the structure comprises a halogen.

30

12. The composition of claim 1, wherein at least one E in the structure is one of alkyl, alkenyl, or alkynyl.
13. The composition of claim 1, wherein at least one E in the structure comprises an alkoxide.
14. The composition of claim 1, wherein each E in the structure comprises an alkoxide.
15. The composition of claim 1, wherein at least one E in the structure is CN.
16. The composition of claim 1, wherein at least one E in the structure is phenol.
17. The composition of claim 1, wherein the agent is in a gaseous state.
18. The composition of claim 1, wherein the product has a quantum yield of at least about 30%.
19. The composition of claim 1, wherein the product has a quantum yield of at least about 40%.
20. The composition of claim 1, wherein the product has a quantum yield of at least about 50%.
21. The composition of claim 1, wherein the compound is substantially non-emissive.
22. The composition of claim 1, wherein the compound is a polymer.
23. The composition of claim 1, wherein the compound has a structure:



wherein  comprises an organic moiety, \ddot{Q} is one of nitrogen or oxygen, and Y is one of H or SiR_3 , each R independently being one of hydrogen and an organic moiety.

- 5 24. The composition of claim 1, wherein the product has increased conjugation relative to at least one of the compound and the agent.
25. The composition of claim 1, wherein the agent comprises an alkylating agent.
- 10 26. The composition of claim 1, wherein the agent comprises sarin.
27. The composition of claim 1, wherein the agent comprises phosgene.
28. The composition of claim 1, wherein the agent comprises thionyl chloride.
- 15 29. The composition of claim 1, wherein the agent comprises tabun.
30. The composition of claim 1, wherein the agent comprises soman.
- 20 31. A composition, comprising:
 a compound able to react with an agent comprising an electrophilic phosphorous, sulfur, or arsenic atom to produce a product having greater emissivity than the compound, wherein the product comprises at least a portion of the compound that has been cyclized upon reaction with the electrophilic phosphorous, sulfur, or arsenic atom.
- 25 32. A composition, comprising:
 a compound having a structure:
 

(comprising an organic moiety, \ddot{Q} being one of nitrogen or oxygen, and Y being one of H or SiR_3 , each R independently being one of hydrogen and an organic moiety,

wherein at least a portion of the compound is able to cyclize upon reaction of the compound with an electrophile able to transform OY into an alkylating agent.

33. The composition of claim 32, wherein the electrophile comprises a phosphate ester.

34. The composition of claim 32, wherein the electrophile comprises an electrophilic phosphorous, sulfur, or arsenic atom.

35. The composition of claim 34, wherein the electrophilic phosphorous, sulfur, or arsenic atom is bonded to more than one electron-withdrawing moiety.

36. The composition of claim 32, wherein the electrophile comprises an electrophilic carbon that is multiply-bonded another electrophilic atom.

37. The composition of claim 32, wherein the electrophile is a chemical warfare agent.

38. The composition of claim 32, wherein \ddot{Q} is nitrogen.

39. The composition of claim 32, wherein \ddot{Q} is oxygen.


40. The composition of claim 32, wherein the compound is a polymer.

41. The composition of claim 32, wherein a shortest bond path between O and \ddot{Q} has at least 5 atoms.

42. The composition of claim 41, wherein a shortest bond path between O and \ddot{Q} has exactly 5 atoms.

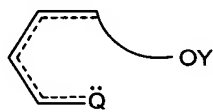
5 43. The composition of claim 32, wherein the compound is able to cyclize upon reaction of the compound with the electrophile to produce a product having a structure:





44. The composition of claim 32, wherein  comprises at least one conjugated group.


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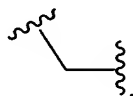
45. The composition of claim 32, wherein  has a structure:




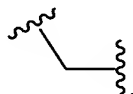
wherein the structure  comprises at least one conjugated group, and  comprises at least one carbon atom.

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46. The composition of claim 45, wherein  comprises a structure:



47. The composition of claim 45, wherein  consists of a structure:




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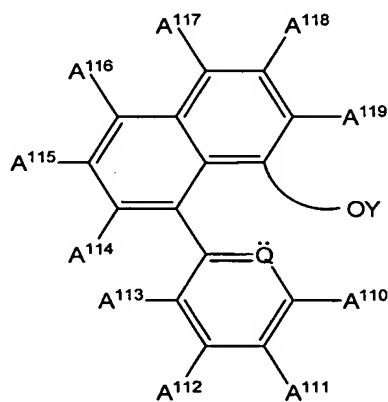
48. The composition of claim 45, wherein the structure  comprises at least two conjugated groups.

49. The composition of claim 48, wherein the two conjugated groups are not
5 conjugated with each other.

50. The composition of claim 48, wherein the two conjugated groups are phenolic groups.

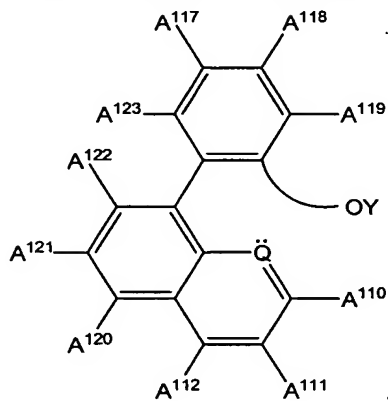
10 51. The composition of claim 48, wherein the structure  comprises at least three conjugated groups.

52. The composition of claim 45, wherein the compound comprises a structure:



15 wherein at least one or more of A^{110} , A^{111} , A^{112} , A^{113} , A^{114} , A^{115} , A^{116} , A^{117} , A^{118} , and A^{119} is one of hydrogen, an organic moiety, or a polymer.

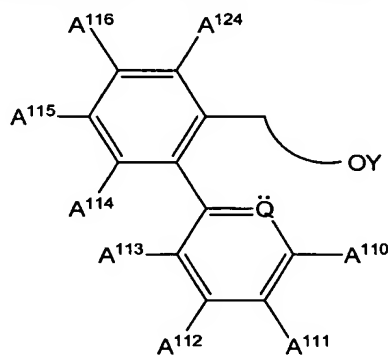
53. The composition of claim 45, wherein the compound comprises a structure:



wherein at least one or more of A¹¹⁰, A¹¹¹, A¹¹², A¹¹³, A¹¹⁷, A¹¹⁸, A¹¹⁹, A¹²⁰, A¹²¹, A¹²², and A¹²³ is one of hydrogen, an organic moiety, or a polymer.

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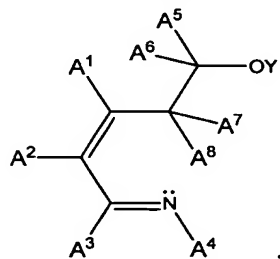
54. The composition of claim 45, wherein the compound comprises a structure:



wherein at least one or more of A¹¹⁰, A¹¹¹, A¹¹², A¹¹³, A¹¹⁴, A¹¹⁵, A¹¹⁶ and A¹²⁴ is one of hydrogen, an organic moiety, or a polymer.

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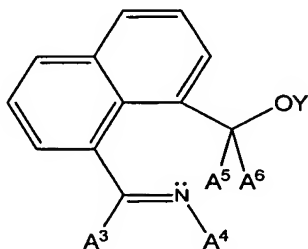
55. The composition of claim 32, wherein the compound has a structure:



wherein at least one or more of A¹, A², A³, A⁴, A⁵, A⁶, A⁷, and A⁸ comprises at least one conjugated group.

56. The composition of claim 55, wherein each of A⁵, A⁶, A⁷, and A⁸ independently is hydrogen.

5 57. The composition of claim 55, wherein the compound has a structure:



58. The composition of claim 57, wherein each of A⁵ and A⁶ independently is hydrogen.

10

59. The composition of claim 57, wherein A³ and A⁴ together comprise a conjugated group.

60. The composition of claim 59, wherein the conjugated group is cyclic.

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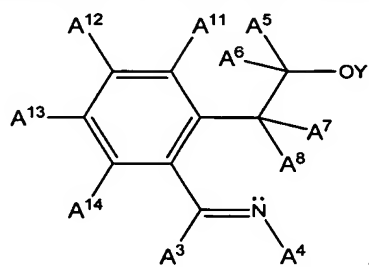
61. The composition of claim 60, wherein the conjugated group is aromatic.

62. The composition of claim 55, wherein A¹ and A² together comprise a conjugated group.

20

63. The composition of claim 62, wherein the conjugated group is cyclic.

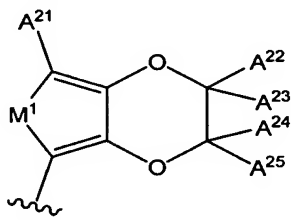
64. The composition of claim 55, wherein the compound has a structure:



wherein each of A^{11} , A^{12} , A^{13} , and A^{14} independently comprise at least one atom.

65. The composition of claim 64, wherein at least one of A^{11} , A^{12} , A^{13} , and A^{14} comprises a conjugated group.

66. The composition of claim 65, wherein the conjugated group has a structure:

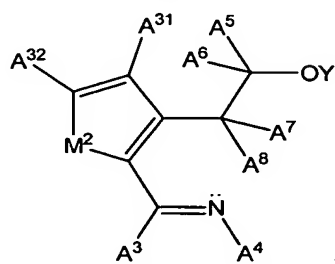


- wherein each of A^{21} , A^{22} , A^{23} , A^{24} , and A^{25} independently comprise at least one atom, and M^1 is a chalcogen.

67. The composition of claim 66, wherein A^{12} is the conjugated group.

68. The composition of claim 66, wherein each of A^{21} , A^{22} , A^{23} , A^{24} , and A^{25} is hydrogen.

69. The composition of claim 55, in the compound has a structure:



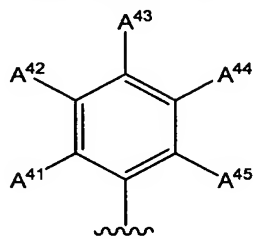
wherein each of A^{31} and A^{32} comprise at least one atom, and M^2 is a chalcogen.

70. The composition of claim 69, wherein M^2 is sulfur.

71. The composition of claim 69, wherein at least one of A^{31} and A^{32} comprises a
5 conjugated group.

72. The composition of claim 71, wherein the conjugated group is cyclic.

73. The composition of claim 72, wherein the conjugated group has a structure:



10

wherein each of A^{41} , A^{42} , A^{43} , A^{44} , and A^{45} independently comprise at least one atom.

74. The composition of claim 73, wherein A^{32} is the conjugated group.

15

75. The composition of claim 74, wherein at least one of A^{41} , A^{42} , A^{43} , A^{44} , and A^{45} comprises an amine.

76. The composition of claim 75, wherein the amine is a tertiary amine.

20

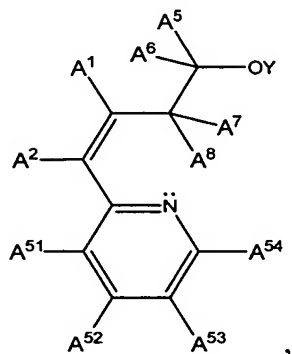
77. The composition of claim 75, wherein the amine is dimethylamine.

78. The composition of claim 75, wherein A^{43} comprises the amine.

25 79. The composition of claim 55, wherein A^3 and A^4 together comprise a conjugated group.

80. The composition of claim 79, wherein the conjugated group is cyclic.

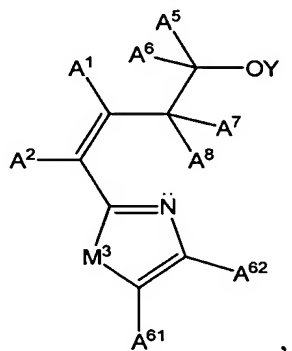
81. The composition of claim 55, wherein the compound has a structure:



wherein each of A⁵¹, A⁵², A⁵³, and A⁵⁴ independently comprise at least one atom.

5

82. The composition of claim 55, wherein the compound has a structure:

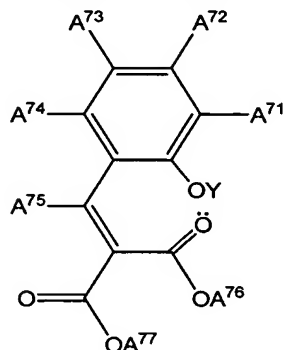


wherein each of A⁶¹ and A⁶² independently comprise at least one atom, and M³ is a chalcogen.

10

83. The composition of claim 82, wherein M³ is sulfur.

84. The composition of claim 23, wherein the compound has a structure:



wherein each of A^{71} , A^{72} , A^{73} , A^{74} , A^{75} , A^{76} , and A^{77} independently is hydrogen, an organic moiety, or a polymer.

5

85. The composition of claim 84, wherein each of A^{76} and A^{77} is ethyl.

86. The composition of claim 84, wherein each of A^{71} , A^{72} , A^{73} , A^{74} , and A^{75} is hydrogen.

10

87. A composition, comprising:

a compound having at least two conjugated groups connected by a single covalent bond, the conjugated groups thereby being able to rotate about the single covalent bond independently of each other, the conjugated groups not in substantial pi-conjugation with each other,

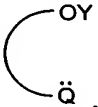

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wherein the compound is able to react with an electrophile to produce a product in which the two conjugated groups are connected such that the ability of the two conjugated groups to rotate independently of each other is diminished.

- 20 88. The composition of claim 87, wherein the compound is able to react with the electrophile to produce an alkylating agent.

89. The composition of claim 88, wherein the alkylating agent comprises a phosphate ester.

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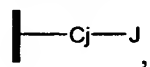
90. The composition of claim 87, wherein at least one of the at least two conjugated groups comprises an aromatic moiety.
91. The composition of claim 87, wherein each of the at least two conjugated groups independently comprises an aromatic moiety.
92. The composition of claim 87, wherein, in the product, the at least two conjugated groups are connected by at least two separate covalent bonds.
93. The composition of claim 87, wherein, in the product, the at least two conjugated groups are in substantial pi-conjugation with each other.
94. The composition of claim 87, wherein the compound has a structure:
- 
- wherein  comprises an organic moiety, Q̈ is one of nitrogen or oxygen, and Y is one of H or SiR₃, each R independently being one of hydrogen and an organic moiety.
95. The composition of claim 87, wherein the compound is a polymer.
96. The composition of claim 87, wherein the product has a higher emissivity than the compound.
97. The composition of claim 87, wherein the product has a smaller band gap than the compound.
98. The composition of claim 87, wherein the product has a quantum yield of at least about 30%.

99. A composition, comprising:
a compound having a structure $C_j^1-C_j^2-OY$, C_j^1 and C_j^2 each independently being conjugated groups not in substantial pi-conjugation with each other, and Y being one of H or SiR_3 , each R independently being one of hydrogen and an organic moiety,
5 wherein the compound is able to react with an electrophile such that C_j^1 and C_j^2 become substantially pi-conjugated with each other.
100. The composition of claim 99, wherein the compound is able to react with the electrophile to produce an alkylating agent.
10
101. The composition of claim 90, wherein the alkylating agent comprises a phosphate ester.
102. The composition of claim 99, wherein at least one of C_j^1 and C_j^2 comprises an aromatic moiety.
15
103. The composition of claim 99, wherein each of C_j^1 and C_j^2 comprises an aromatic moiety.
20
104. The composition of claim 99, wherein the compound is a polymer.
105. The composition of claim 99, wherein the compound is able to react with the electrophile to increase the emissivity of the compound.
25
106. A composition, comprising:
a substantially non-emissive compound able to react with an electrophile to produce an emissive compound.
107. The composition of claim 106, wherein the substantially non-emissive compound is able to react in the presence of air to produce the emissive compound.
30

108. The composition of claim 106, wherein the substantially non-emissive compound is able to react with an electrophile to produce an alkylating agent.
109. The composition of claim 108, wherein the alkylating agent comprises a
5 phosphate ester.
110. The composition of claim 106, wherein the substantially non-emissive compound is a polymer.
- 10 111. A composition, comprising:
a polymer having a structure:
$$\text{I} - \text{C}_j - \text{J}$$

I being a substantially pi-conjugated polymer backbone, C_j being non-existent or comprising at least one conjugated group, and J being a moiety not substantially
15 pi-conjugated with I,
wherein J is able to react with an electrophile such that J becomes
substantially pi-conjugated with at least one of I and C_j, if present, upon reaction
with the electrophile.
- 20 112. The composition of claim 111, wherein J is able to react with the electrophile to produce an alkylating agent.
113. The composition of claim 112, wherein the alkylating agent comprises a
25 phosphate ester.
114. The composition of claim 111, wherein the polymer is substantially non-emissive.
115. The composition of claim 111, wherein, upon pi-conjugation of J with at least
30 one of I and C_j, if present, the polymer is emissive.

116. A composition, comprising:
a polymer having a structure:



- 5 --- being a substantially pi-conjugated polymer backbone, C_j being non-existent or comprising at least one conjugated group, and J being a moiety not substantially pi-conjugated with --- ,
wherein the polymer has an emissivity that is altered upon reaction of J with an electrophile.

- 10 117. The composition of claim 116, wherein J is able to react with the electrophile to produce an alkylating agent.

118. The composition of claim 117, wherein the alkylating agent comprises a phosphate ester.

- 15 119. The composition of claim 116, wherein the polymer is substantially non-emissive.

- 20 120. The composition of claim 116, wherein, upon pi-conjugation of J with at least one of --- and C_j , if present, the polymer is emissive.

121. A composition, comprising:
a sensor comprising a compound reactive with an electrophile, wherein the compound is able to react with the electrophile to form a non-preexisting product having increased conjugation relative to any compound involved in the reaction.

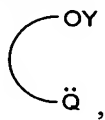
- 25 122. The composition of claim 121, wherein the compound is able to react with the electrophile to form an alkylating agent.


- 30 123. The composition of claim 122, wherein the alkylating agent comprises a phosphate ester.

124. The composition of claim 121, wherein the product has a greater emissivity than the compound.

5 125. The composition of claim 121, wherein the compound is a polymer.

126. The composition of claim 121, wherein the compound has a structure:



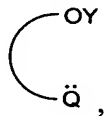
10 wherein  comprises an organic moiety, Q is one of nitrogen or oxygen, and Y is one of H or SiR₃, each R independently being one of hydrogen and an organic moiety.


127. A method, comprising:

15 reacting a compound with an electrophile to produce a product having greater emissivity than the compound, wherein the product comprises at least a portion of the compound that has been cyclized upon reaction with the electrophile.

128. A method, comprising:

20 cyclizing at least a portion of a compound by reacting the compound with an electrophile, the compound having a structure:



25  comprising an organic moiety, Q being one of nitrogen or oxygen, and Y being one of H, an alkyl group, an alkoxy group, and SiR₃, each R independently being one of hydrogen and an organic moiety.

129. A method, comprising:

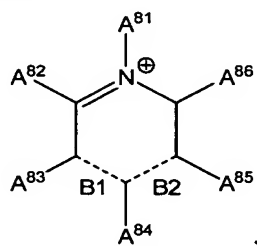
reacting a compound having at least two conjugated groups connected by a single covalent bond, the conjugated groups thereby being able to rotate about the single covalent bond independently of each other, the conjugated groups not in substantial pi-conjugation with each other, with an electrophile to produce a product in which the two conjugated groups are connected such that the ability of the two conjugated groups to rotate independently of each other is diminished.

130. A method, comprising:

reacting a compound having a structure $C_j^1-C_j^2-OY$, C_j^1 and C_j^2 each independently being conjugated groups not in substantial pi-conjugation with each other and Y being one of H, an alkyl group, an alkoxy group, and SiR_3 , each R independently being one of hydrogen and an organic moiety, with an electrophile such that C_j^1 and C_j^2 become substantially pi-conjugated with each other.

131. A method, comprising:

reacting a compound with an alkylating agent to produce a product having a structure:



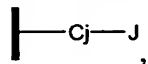
wherein at least one or more of A^{81} , A^{82} , A^{83} , A^{84} , A^{85} , and A^{86} comprise at least one conjugated group, and each of B1 and B2 is a single bond or a double bond such that B1 and B2 both are not double bonds.

132. A method, comprising:

reacting a substantially non-emissive compound with an electrophile to produce an emissive compound.

133. A method, comprising:

providing a polymer having a structure:



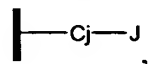
being a substantially pi-conjugated polymer backbone, C_j being non-existent or comprising at least one conjugated group, and J being a moiety not substantially

pi-conjugated with --- ; and

reacting J with an electrophile such that J becomes substantially pi-conjugated with at least one of --- and C_j, if present.

134. A method, comprising:

providing a polymer having a structure:



being a substantially pi-conjugated polymer backbone, C_j being non-existent or comprising at least one conjugated group, and J being a moiety not substantially

pi-conjugated with --- ; and

reacting J with an electrophile to alter an emissivity of the polymer.

135. A method comprising:

exposing a sensor, comprising a compound reactive with an electrophile, to a medium suspected of containing the electrophile;

when the electrophile is present in the medium at at least a detectable level, reacting the electrophile with the compound to form a non-preexisting product having increased conjugation relative to any compound involved in the reaction; and

determining the increased conjugation thereby determining the electrophile in the medium.